Technical Memorandum

Date: May 3, 2022

To: Ohio EPA

From: David L. Elam, Jr.

Project: 483262.0000

Subject: Material Balance Calculations for Ammonia, Dovetail Energy Lagoon, Fairborn, OH, updated to, to correct a data entry error in the April 7, 2022 report, to clarify the use of lagoon, and to include April 4, 2022 sample results, an example calculation, and laboratory reports,

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TRC Environmental Corporation (TRC) was asked to calculate potential ammonia (NH_3) atmospheric emissions from the lagoon at the Dovetail Energy Facility (Dovetail) using a material balance approach. This brief memo provides an overview of the process, the material balance approach, and the results of the material balance calculations. This approach assumes that changes in the total ammoniacal nitrogen (TAN) inventory are due to the volatilization of NH_3 from the lagoon surface.

Process Description: Dovetail receives hog manure and food wastes and mixes them in proportions that vary based on digester chemistry needs. The mixed slurry is then transferred to an adjacent anaerobic digester for the production of biogas which is burned on site to generate electricity. Digestate is discharged from the digester to a tank which has been identified as a lagoon on sample chain of custody forms and lab reports. For consistency with lab reports, this technical memo refers to the tank as the lagoon. The digestate is subsequently removed periodically for land application to amend agricultural land. Over time, the discharge volume from the digester is roughly equal to the volume of slurry that is supplied to it.

Dovetail collects process data including food waste dosing in gallons, hog waste dosing in tons (which is converted to gallons using a conversion factor of 7.8 pounds per gallon), and digestate removed for land application in gallons. Dovetail also collects a variety of analytical data to manage digester chemistry.

Digestate samples are collected periodically from the digester recirculation loop for process monitoring and analyzed for a variety of parameters including pH, total ammoniacal nitrogen (TAN), and total Kjeldahl nitrogen (TKN). The TAN concentration represents the sum of both the ammonia (NH_3) and ammonium (NH_4^+) forms of ammonia. Samples from the recirculation loop are representative of the material that is discharged from the digester to the lagoon. To conduct the material balance, TRC requested that Dovetail collect samples from the lagoon, distant from the pipe from the digester that discharges into the lagoon. The lagoon samples are representative of the digestate that is removed for land application.

Mass Balance Approach: TRC's approach to the mass balance calculations is outlined below:

1. Food waste and hog manure volumes supplied to the digester were recorded daily from March 1, 2022 through April 4, 2022.
2. For the purposes of this preliminary mass balance calculation, the digester feed volume was set equal to the volume removed for land application. In practice, digestate accumulates in the lagoon and is removed periodically.
3. Grab samples were collected from the recirculation loop and lagoon on March 14, 2022, March 21, 2022, March 28, 2022, and April 4, 2022 and analyzed for TAN, TKN, nitrate nitrogen, pH, phosphorous, specific gravity, total solids, and potassium. Material balance calculations were performed for TAN and TKN. The lab reported TAN and TKN concentrations in percent nitrogen (N) which were converted to milligrams per liter (mg/l) by multiplying the reported value by 10,000 (1% = 10,000 ppm = 10,000 mg/l). No adjustments were made for specific gravity because the specific gravity values were very close to 1 gram per milliliter (g/ml).
4. The total dosing volume in gallons was converted to liters using 3.785 liters per gallons.
5. The daily masses of TAN and TKN were calculated by multiplying the concentration in mg/liters by the dosing volume in liters for either the 14-, 21-, 28, or 35-day interval. The resulting value in mg was converted to pounds (lb) using conversion factors of 1,000 mg/g and 454 g/lb. The daily mass was calculated by dividing the total by 14, 21, or 28, as appropriate.
6. Potential emissions, as N, were calculated by subtracting the per day total mass of TAN calculated for the lagoon from the per day total mass of TAN calculated for the recirculation loop. Differences are reported to the nearest tenth while daily values have been reported to the nearest whole number.
7. Potential emissions, as NH_3, were calculated by multiplying emissions as N by the ratio of the molecular weight of NH_3 (17 grams/mole) to that of (14 grams/mole), which is 1.214.
8. An example material balance for the March 1-14, 2022 period sample calculation is provided on page 3.
9. Laboratory reports are provided in Attachment A.

Results: Mass balance calculation results are presented in Tables 1-8 on pages 4-11, respectively. Shaded cells represent sample collection dates.

Example Material Balance Calculations

$Period\ Total\ Food\ Waste\ (Gallons) = \sum$ ⟦March 1 to March 14 (Dosing Gallons/day)⟧ $= 92{,}407\ Gallons$

$Period\ Total\ Food\ Waste\ (Liters) = 92{,}407\ Total\ Food\ Waste\ (Gallons) \times 3.785 \frac{Liters}{Gallon}$

$= 349{,}760\ Liters\ Food\ Waste$

Same Equations Used for Hog Waste Dosing

Example Calculations, Table 2:

$$Recirculation\ Loop\ (mg\ N/Liter) = 0.2797\% \times \frac{1{,}000{,}000\ ppm}{100\%} = 2797\ ppm \times \frac{1\ mg/Liter}{1\ ppm} = 2797\ mg/Liter$$

$$lb\ of\ N = 2797 \frac{mg}{Liter} \times 3.785 \frac{Liter}{Gallon} \times 92{,}407\ Gallons \times \frac{1}{1000 \frac{mg}{g} \times 454 g/lb} = 3256\ lb\ of\ N$$

$$Average\ lb\ of\ N\ per\ day = \frac{3260\ lb}{14\ days} = 233 \frac{lb}{day}\ N$$

Same Equations used for Lagoon

$$Potential\ Emissions\ per\ Day\ as\ N = 233 \frac{lb}{day}\ Recirculation - 214 \frac{lb}{day}\ Lagoon = 18.6 \frac{lb}{day}\ as\ N$$

$$Potential\ Emissions\ per\ Day\ as\ NH3 = 18.3 \frac{lb}{day}\ as\ N \times \frac{17 \frac{g}{mole}\ NH3}{14 \frac{g}{mole}\ N} = 22.6 \frac{lb}{day} as\ NH3$$

Table 1. Food Waste and Hog Manure Dosing Volumes, March 1-14, 2022			
Date	**Food Waste Dosing, Gallons**	**Hog Waste Dosing, Gallons**	**Total Dosing, Gallons**
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
Period Total, gallons	92,407	47,368	139,775
Period Total, liters	349,760	179,289	529,050

Table 2. TAN and TKN Mass Balance Calculations, March 1-14, 2022					
	TAN, mg N/l	**TKN, mg N/l**	**Notes**	**TAN, lb of N**	**TKN, lb of N**
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
***Average*[1]**	2,797	3,150	Period Total	3,256	3,671
			Per Day Total	233	262
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
***Average*[1]**	2,574	3,190	Period Total	3,000	3,717
			Per Day Total	214	266
Difference			Per Day	18.6	-3.3
Potential Emissions, as N			**Per Day**	**18.6**	---
Potential Emissions, as NH_3			**Per Day**	**22.6**	---
[1]There is only one value for the average calculation.					

Table 3. Food Waste and Hog Manure Dosing Volumes, March 1-21, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
Period Total, gallons	135,793	73,684	209,477
Period Total, liters	513,977	278,895	792,871

Table 4. TAN and TKN Mass Balance Calculations, March 1-21, 2022					
	TAN, mg N/l	**TKN, mg N/l**	**Notes**	**TAN, lb of N**	**TKN, lb of N**
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
Average	2,760	2,975	Period Total	4,823	5,196
			Per Day Total	230	247
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
Average	2,390	2,980	Period Total	4,173	5,204
			Per Day Total	199	248
Difference			Per Day	30.8	-0.4
Potential Emissions, as N			**Per Day**	**331.0**	---
Potential Emissions, as NH_3			**Per Day**	**37.6**	---

Table 5. Food Waste and Hog Manure Dosing Volumes, March 1-28, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
3/22/2022	6,617	0	6,617
3/23/2022	6,423	5,263	11,686
3/24/2022	7,150	5,263	12,413
3/25/2022	7,221	5,263	12,484
3/26/2022	7,500	0	7,500
3/27/2022	7,500	0	7,500
3/28/2022	7,500	5,263	12,763
Period Total, gallons	185,704	94,737	280,441
Period Total, liters	702,890	358,579	1,061,469

Table 6. TAN and TKN Mass Balance Calculations, March 1-28, 2022					
	TAN, mg/L	**TKN, mg/L**		**TAN, lb of N**	**TKN, lb of N**
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
March 28, 2022	2,969	3,310	pH = 8.23		
Average	2,830	3,087	Period Total	6,619	7,217
			Per Day Total	236	258
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
March 28, 2022	2,932	2,800	pH = 6.18		
Average	2,570	2,920	Period Total	6,010	6,827
			Per Day Total	215	244
Difference			Per Day	21.8	13.9
Potential Emissions, as N			**Per Day**	**21.8**	---
Potential Emissions, as NH_3			**Per Day**	**26.4**	---

Table 7. Food Waste and Hog Manure Dosing Volumes, March 1, 2022 – April 4, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
3/22/2022	6,617	0	6,617
3/23/2022	6,423	5,263	11,686
3/24/2022	7,150	5,263	12,413
3/25/2022	7,221	5,263	12,484
3/26/2022	7,500	0	7,500
3/27/2022	7,500	0	7,500
3/28/2022	7,500	5,263	12,763
3/29/2022	8,216	5,263	13,479
3/30/2022	9,126	5,263	14,389
3/31/2022	9,415	5,263	14,678
4/1/2022	9,512	5,263	14,775
4/2/2022	9,500	0	9,500
4/3/2022	9,500	0	9,500
4/4/2022	9,500	5,263	14,763
Period Total, gallons	250,473	121,053	371,526
Period Total, liters	948,040	458,184	1,406,225

Table 8. TAN and TKN Mass Balance Calculations, March 1, 2022 – April 4, 2022					
	TAN, mg/L	**TKN, mg/L**		**TAN, lb of N**	**TKN, lb of N**
Recirculation Loop					
March 14, 2022	2,794	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
March 28, 2022	2,969	3,310	pH = 8.23		
April 4, 2022	2,650	2,920	pH = 6.32		
Average	2,785	3,045	Period Total	8,6268	9.432
			Per Day Total	247	269
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
March 28, 2022	2,932	2,800	pH = 6.18		
April 4, 2022	2,070	2,070	pH = 7.89		
Average	2,445	2,708	Period Total	7,574	8,386
			Per Day Total	216	240
Difference			Per Day	30	29.9
Potential Emissions, as N **Potential Emissions, as NH_3**			**Per Day** **Per Day**	**30.1** **36.6**	--- ---

Attachment A: Laboratory Reports

Note that lab reports use "Discharge" for what has been identified in this memo as the "Recirculation Loop." The sample collection date is missing on the April 6, 2022 report. Asura Associates contacted Renergy and confirmed the April 4, 2022 collection date.

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/14/2022
Date Received: 03/15/2022

Lab Number: ZE0315021
Location: LAGOON
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-17	NLS	0.257403 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-16	BAT	0.00013 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-17	jk	0.319 %	0.01
IA590	pH		4500H-B		Mar-15	LMP	6.3 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-16	Mar-17	ALP	643.4 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-17	LMP	.9984425 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-18	LMP	3.552 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-16	Mar-17	ALP	497.45 mg/l	5

Approval

Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/14/2022
Date Received: 03/15/2022

Lab Number: ZE0315022
Location: DISCHARGE
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-17	NLS	0.279747 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-16	BAT	0.00035 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-17	jk	0.315 %	0.01
IA590	pH		4500H-B		Mar-15	LMP	8.1 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-16	Mar-17	ALP	907.15 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-17	LMP	1.002806 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-18	LMP	2.598 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-16	Mar-17	ALP	667.25 mg/l	5

Approval

Erica Huber
Environmental Laboratory Manager

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FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests 58251

Date Submitted: 3/14/2022 **Client #:** 58251(jw1702) -224 **# Samples Submitted** 2

Client Name: Dovetail Bio Energy **Consultant:** Shane Eagle

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** Shane Eagle

Office Use AEM
Form #: ___ Due Date: 3-18-22
No. Samples Rec'd: 3
Date Rec'd: ___
Rec'd By: ___

Check box if data is to be: ☐ Fax #___ ■ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: ___yes ___no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha				Sample Depth: ___ inches ___cm			
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon			ZE03	15021						
Discharge			ZE03	15022						

Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 (Manure, Fert., Lime): ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L002

■ Other EE260 If other tests are required on certain samples, note the samples below and specify the test by Index code. (See backside.)

3 Day turn around

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/21/2022
Date Received: 03/22/2022

Lab Number: ZE0322003
Location: LAGOON
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-24	NLS	0.220505 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-24	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-25	JK	0.277 %	0.01
IA590	pH		4500H-B		Mar-22	ALP	6.06 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-23	Mar-25	LMP	710.6 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-22	ALP	.9894607 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-22	ALP	3.88 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-23	Mar-25	LMP	449.55 mg/l	5

Approval

Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

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Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/21/2022
Date Received: 03/22/2022

Lab Number: ZE0322004
Location: DISCHARGE
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-24	NLS	0.2726 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-24	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-25	JK	0.28 %	0.01
IA590	pH		4500H-B		Mar-22	ALP	7.96 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-23	Mar-25	LMP	999.45 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-22	ALP	1.004552 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-22	ALP	2.722 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-23	Mar-25	LMP	675.6 mg/l	5

Approval

Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

58251 AEA

Index 130 **BROOKSIDE LABORATORIES, INC.,** 200 White Mountain Drive New Bremen, OH 45869 Page 1 of 1

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 3/21/2022 **Client #:** 58251(jw1703) -227- **# Samples Submitted** 2

Client Name: Dovetail Bio Energy **Consultant:** Shane Eagle

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** Shane Eagle

Office Use
Form #: ____ Due Date: ____
No. Samples Rec'd: ____
Date Rec'd: ____
Rec'd By: ____

Check box if data is to be: ☐ Fax # ____ ■ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: ___ yes ___ no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha				Sample Depth: ____ inches ____ cm			
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon		ZE0322003								
Discharge		ZE0322004								

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Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 (Manure, Fert., Lime): ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L002

■ Other EE260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 Day turn around

58251 AEM

FRO 691

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 3/21/22 **Client #:** 58251-229 **# Samples Submitted** 2

Client Name: Renergy **Consultant:** R.O.

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** R.O.

Office Use
Form #: ___ Due Date: ___
No. Samples Rec'd: ___
Date Rec'd: ___
Rec'd By: ___

Check box if data is to be: ☐ Fax #_____ ☐ e-mail: (address) Froberfield@renergy.com

Soil Audit Format:	ppm: ___ yes ___ no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha				Sample Depth: ___ inches ___ cm			
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
EMD DP Discharge 3/21/22			ZE0323025							
EMD Lagoon NEL 3/21/22			ZE0323026							

Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 **(Manure, Fert., Lime):** ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L002

☒ Other [redacted] EE260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.

[redacted] 3 Day turn around

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/28/2022
Date Received: 03/29/2022

Lab Number: ZE0329014
Location: LAGOON
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-30	NLS	0.293186 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-31	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-30	JK	0.28 %	0.01
IA590	pH		4500H-B		Mar-31	ALP	6.18 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-29	Mar-30	LMP	431.5 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-30	ALP	1.016814 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-30	ALP	1.809 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-29	Mar-30	LMP	405.55 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

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Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/28/2022
Date Received: 03/29/2022

Lab Number: ZE0329015
Location: DISCHARGE
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-30	NLS	0.2969 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-31	BAT	0.00025 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-30	JK	0.331 %	0.01
IA590	pH		4500H-B		Mar-31	ALP	8.23 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-29	Mar-31	LMP	1032.1 mg/kg	100
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-30	ALP	1.022897 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-30	ALP	2.689 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-29	Mar-31	LMP	590.2 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

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58251 AEM 4/11

Index 130 **BROOKSIDE LABORATORIES, INC.,** 200 White Mountain Drive New Bremen, OH 45869 Page 1 of 1

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 3/28/2022 **Client #:** 58251(jw1704) -230 SH **# Samples Submitted** 2

Client Name: Dovetail Bio Energy **Consultant:** Shane Eagle

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** Shane Eagle

Office Use
Form #: ____ Due Date: _____
No. Samples Rec'd: _____
Date Rec'd: _____
Rec'd By: _____

Check box if data is to be: ☐ Fax #_____ ■ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: ___yes ___no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha						Sample Depth: ____ inches ____cm	
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon	VE	ZE03	29014							
Discharge	VE	ZE03	29015							

Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 **(Manure, Fert., Lime):** ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L002

■ Other EE260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 Day turn around

58251
AEM
4/1/22

Index 4.50 BROOKSIDE LABORATORIES, INC., 200 Wilkinson Drive New Bremen, OH 45869 Page ___ of ___

FRO 392

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 3/28/22 **Client #:** 58251 **# Samples Submitted** 2

Client Name: Renergy **Consultant:** R. O.

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** R. O.

Office Use
Form #: ____ Due Date: ____
No. Samples Rec'd: ____
Date Rec'd: ____
Rec'd By: ____

Check box if data is to be: ☐ Fax #_____ ☐ e-mail: (address) Froberfield@renergy.com

Soil Audit Format:	ppm: ___ yes ___ no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha				Sample Depth: ___ inches ___ cm			
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
EMD DP discharge 3/26/22	VE	ZE03	3019							
EMD Lagoon NEL 3/26/22	VE	ZE03	30020							

Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 **(Manure, Fert., Lime):** ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L00:

☒ Other [redacted] EE260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.

[redacted] 3 Day turn Around

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected:
Date Received: 04/06/2022

Lab Number: ZE0406012
Location: LAGOON
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Apr-08	BLH	0.207 %	0.01
IA490	NITROGEN-NITRATE		300.0		Apr-07	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Apr-08	JK	0.207 %	0.01
IA590	pH		9045D		Apr-06	LMP	6.32 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Apr-07	Apr-07	ALP	507.6 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Apr-06	LMP	1.0008 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Apr-07	LMP	2.025 %	0.01
IB200	POTASSIUM	3050B	6010C	Apr-07	Apr-07	ALP	447.8 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

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Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected:
Date Received: 04/06/2022

Lab Number: ZE0406013
Location: DISCHARGE
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Apr-08	BLH	0.265 %	0.01
IA490	NITROGEN-NITRATE		300.0		Apr-07	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Apr-08	JK	0.292 %	0.01
IA590	pH		9045D		Apr-06	LMP	7.89 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Apr-07	Apr-07	ALP	942.4 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Apr-06	LMP	.99322 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Apr-07	LMP	2.678 %	0.01
IB200	POTASSIUM	3050B	6010C	Apr-07	Apr-07	ALP	699.1 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

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58251 AEM 4/11/22

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FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 4/4/2022 **Client #:** 58251(jw1705) #235 **# Samples Submitted** 2

Client Name: Dovetail Bio Energy **Consultant:** Shane Eagle

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** Shane Eagle

Office Use
Form #: ____ Due Date: ____
No. Samples Rec'd: ____
Date Rec'd: ____
Rec'd By: ____

Check box if data is to be: ☐ Fax #____ ■ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: ___yes ___no		Report unit: pick one: ☐ lb/ac ☐ lbs/1000 sq. ft. ☐ kg/ha				Sample Depth: ____inches ____cm			
(16 Characters ea.)	Sample 1 (8 characters ea)		Sample 2 (8 characters ea)		Sample 3 (8 characters ea)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon		ZE0406012								
Discharge		ZE0406013								
					Bottles not labelled					

Please check desired package (Soil): ☐S001 ☐S001P ☐S001A ☐S001B ☐S001C ☐S110 ☐S113 ☐S001N ☐S001AN ☐S001BN ☐S001CN ☐S001PN ☐S002 ☐S003 ☐S004 ☐S004LM ☐S005 ☐S006 ☐S006W=client H20 ☐S007 ☐S015 ☐S015N ☐S019 ☐S008 ☐S009 ☐S009LM ☐S010 ☐S011 ☐S017 ☐S171 ☐S180 ☐S251 (Manure, Fert., Lime): ☐Z001 ☐Z002 ☐Z003 ☐Z004 ☐X001 ☐X002 ☐X003 ☐L001 ☐L002

■ Other EE260 If other tests are required on certain samples, note the samples below and specify the test by Index code. (See backside.)

3 Day turn around